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GROUND-WATER MONITORING REPORT

KUMMER LANDFILL
BELTRAMI COUNTY, MINNESOTA

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 5

Waste Management Division
Office of Superfund
Chicago, Illinois 60604

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1.0 INTRODUCTION

At the request of the U.S. Environmental Protection Agency (EPA), PRC Environmental Management, Inc. (PRC), conducted ground-water monitoring of existing ground-water wells at the Kummer Landfill Superfund (Kummer) Site in Northern Township, Beltrami County, Minnesota, on April 27 and 28, 1992. The monitoring is part of the scope of work for remedial design under EPA work assignment No. 34-5NR8. Sample analysis was conducted by PRC's field analytical support (FAS) laboratory and Versar Laboratories, Inc. (Versar). This report summarizes the sampling and analytical programs used and discusses the results of the sampling effort.

The discussion that follows is based on procedures specified in the final Sampling, Analysis, and Quality Assurance Project Plan (sampling plan) approved by EPA on April 22, 1992. Unless otherwise indicated, ground-water monitoring activities for this project followed methods and specifications outlined in the sampling plan.

2.0 SAMPLING PROGRAM

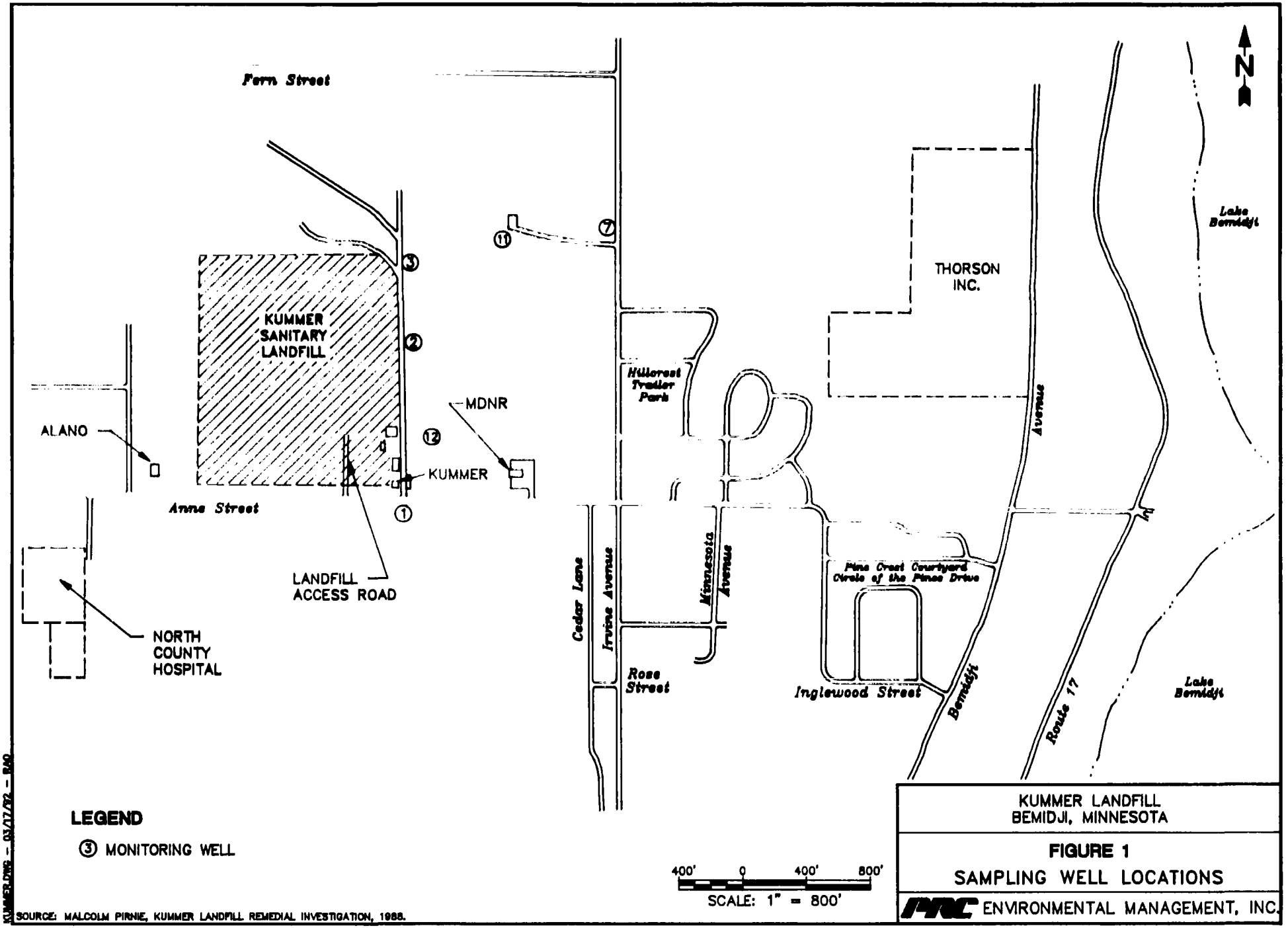
This section discusses the details of the field sampling program used at the Kummer site.

2.1 SAMPLING OBJECTIVES

As described in the sampling plan, the objective for this project was to define current ground-water contaminant concentrations. In addition, the collected data will be used to support remedial design activities such as ground-water modeling. PRC sampled wells previously identified by EPA and the Minnesota Pollution Control Agency (MPCA) as having potential for containing contamination at significant levels. Wherever technically reasonable, the monitoring results are compared to ground-water data already collected at the site.

2.2 MONITORING WELLS

Figure 1 shows the locations of monitoring wells sampled by PRC at the Kummer site. Well 16A was included in the approved sampling plan, but was not sampled by PRC because it was removed in the fall of 1991 during the installation of the landfill cap. The remaining wells


Fern Street
KUMMER SANITARY LANDFILL
ALANO
Anne Street
MDNR
KUMMER
LANDFILL ACCESS ROAD
NORTH COUNTY HOSPITAL
Hillcrest Trailer Park
THORSON INC.
Cedar Lane
Irvine Avenue
Minnesota Avenue
Rose Street
Pine Crest Courtyard
Circle of the Pines Drive
Inglewood Street
Bemidji Avenue
Route 17
Lake Bemidji
Lake Bemidji
N
LEGEND
③ MONITORING WELL
400' 0 400' 800'
SCALE: 1" = 800'
KUMMER LANDFILL
BEMIDJI, MINNESOTA
FIGURE 1
SAMPLING WELL LOCATIONS
MEC ENVIRONMENTAL MANAGEMENT, INC.
SOURCE: MALCOLM PIRNIE, KUMMER LANDFILL REMEDIAL INVESTIGATION, 1988.

designated in the sampling plan were in place and in good condition for sampling. All well caps were undamaged and secured with locks corresponding to the keys given to PRC by the MPCA.

Table 1 shows the physical characteristics of the wells sampled by PRC. Casing diameters and screen lengths were obtained from the remedial investigation (RI) report submitted to MPCA by Malcolm Pirnie in April 1988. Depth-to-water measurements were made by PRC using an electric water-level indicator. Total well depth measurements were made from the top of the well casing (TOC). As described in the sampling plan, purge volumes for each well were calculated as described on the monitoring well field sampling sheet for the particular well casing diameter. A minimum of three well volumes of ground water were purged before sampling. Temperature, pH, and specific conductivity were monitored until two successive temperature, pH, and specific conductivity readings indicated that these parameters had stabilized.

Only one well, well 1A, was purged to dryness before three well volumes were removed. Samples were taken from well 1A as soon as the well recharged and a sufficient volume of ground water was available. As specified in the sampling plan, four 40-milliliter (ml) vials were filled with ground water from each sampled well for volatile organic compound (VOC) analysis. An approximate volume of 500 ml was collected at each sampled well for barium analysis, not the 1 liter bottle, as specified in the sampling plan. Routine analysis of barium by the FAS laboratory typically requires only 100 ml.

Bladder pumps were used to collect ground-water samples after wells were purged. As described in the sampling plan, polyethylene hose was used to transfer the samples into the sample containers. The hose was disposed of after the sampling of each well was complete and new hose was used at the next well. The wells in Table 1 are listed in the order in which they were sampled. Based on RI results, well 3C was determined to be the least likely to be contaminated, while well 12B was expected to be the most contaminated.

2.3 WELL 12B INTERVAL SAMPLING

Well 12B is a 6-inch diameter well with a 30-foot screen. To obtain detailed monitoring information, PRC sampled well 12B using a packer assembly that isolated distinct intervals of the well screen. The measured height of the water column in well 12B was 26.97 feet. Five-foot sampling intervals were specified in the sampling plan; however, the configuration of the pump

TABLE 1

MONITORING WELL CHARACTERISTICS

Well No.	Casing Diameter[1] (inches)	Screen Length[1] (feet)	Measured Total Depth[2] (feet)	Measured Depth to Water[2] (feet)	Height of Water Column[2] (feet)
3C	4	5	47.35	11.88	35.47
2B	2	5	38.15	17.52	20.63
3B	2	5	31.12	11.45	19.67
11B	2	5	30.45	8.93	21.52
1C	4	5	63.00	24.91	38.09
1B	2	5	45.18	24.81	20.37
1A	2	10	27.45	24.84	2.61
3A	2	10	16.10	11.76	4.34
7A	2	10	16.48	3.61	12.87
2A	2	10	25.96	17.45	8.51
12B-45	6	30	48.71	21.74	26.97
12B-38	6	30	48.71	21.74	26.97
12B-31	6	30	48.71	21.74	26.97

Notes:

1 Source: Malcolm Pirnie 1989 Remedial Investigation.

2 Measured by PRC on April 27 and 28, 1992.

and packer assembly limited the sampling intervals to three. The following three intervals were sampled:

WELL INTERVAL (feet below TOC)	SAMPLE NUMBER
45.35 to 38.05	KL-12B-45
38.05 to 30.75	KL-12B-38
30.75 to 23.45	KL-12B-31

The total depth of well 12B was 48.71 feet and the bottom packer assembly, which was placed at the bottom of the well, measured 3.36 feet; therefore, the bottom of the first sampling interval was 45.35 feet below the TOC. The sample numbers represent the approximate depth of the bottom of the sampling interval. For example, 12B-45 identifies the sampling interval from 38.05 to 45.35 feet below the TOC.

Although the actual bladder pump screen was 5 feet long, the distance between the packer seals was 7.3 feet. So ground water could have been drawn from around the metal assemblies that connect the packers to the top and bottom of the pump. However, most of the sample volume was probably drawn from the soil around the 5-foot pump interval.

When completely assembled, the entire pump and packer assembly is almost 14 feet long. Because of the weight of the assembly, a small crane was necessary to suspend the pump and packer in the well. Nitrogen gas was used to inflate the packers. A clean, dedicated steel cable was used to suspend the pump and packer assembly in the well.

Water from well 12B was orangish-brown and opaque, but the water from other wells was generally clear.

2.4 QUALITY CONTROL SAMPLES

Quality control samples were collected as outlined in the sampling plan. Quality assurance sampling results are discussed in Section 3.4. Trip blanks were prepared at the beginning of each day of sampling. One matrix spike/matrix spike duplicate (MS/MSD) sample was collected at

well 1B. For convenience, from this point on, sample numbers and well numbers will be the same in this report. Field duplicate samples were collected from wells 2B and 12B-38.

Field equipment blanks were collected by pumping HPLC-grade water through the decontaminated bladder pump. The bladder pump was placed in a 6-foot polyvinyl chloride (PVC) tube repeatedly rinsed with distilled water. After the pump was decontaminated with distilled water, HPLC-grade water was placed in the tube and pumped through the bladder pump. Field equipment blanks were collected from the hose connected to the pump. Samples were labeled as field equipment blanks and with the identification number of the well to be sampled next. For example, "KL-7A-Blank" identifies the sample of HPLC-grade water drawn from the decontaminated bladder pump before the sampling of well 7A. Field equipment blanks were collected before wells 7A and 11B were sampled.

3.0 ANALYTICAL PROGRAM

This section describes the analytical procedures followed and the results obtained for the ground-water monitoring at the Kummer Site. The first section discusses the data quality objectives for this sampling effort. The next two sections discuss results of VOC and barium analyses, respectively. The last section presents results of quality control procedures.

3.1 DATA QUALITY OBJECTIVES

Data quality objectives for this sampling effort are discussed in the EPA-approved sampling plan. The FAS laboratory analyzed samples for both VOCs and barium using Level 3 quality control limits as specified in the sampling plan. EPA data quality Level 3 was chosen to provide engineering-level results and documentation and validation comparable to Contract Laboratory Program (CLP) protocols. EPA Level 3 data quality parameters, such as precision and accuracy, completeness, representativeness, and comparability achieved, are typically as stringent as those specified in the CLP. However, full CLP documentation protocols were not used. Quality control results are discussed further in Section 3.3.

Nine samples were sent to Versar for confirmatory VOC analysis. Versar used quality control protocols designated Tier 3, which are comparable to the CLP protocols.

3.2 VOLATILE ORGANIC COMPOUNDS

Table 2 presents the results of VOC analyses for samples taken at the Kummer Site. For four of the five VOC contaminants of concern, the sample quantitation limits (SQL) achieved were lower than the target detection limits specified in the sampling plan. Samples for which no VOCs were detected are assigned the value of less than (<) the SQL for the specific contaminant. For example, the SQL achieved by the FAS for benzene was 5.0 micrograms per liter (μg/L). Because benzene was detected in only one of the samples, most samples are reported as containing < 5 μg/L of benzene. The qualifier "U" follows the numerical value to indicate that there was no contaminant detected in the sample.

The sample quantitation limit obtained for chloroethene (vinyl chloride) was higher than the target detection limit specified in the sampling plan, so PRC arranged for additional VOC analysis by Versar. PRC specified a target detection limit of 10 μg/L for vinyl chloride which was in the sampling plan. Results of the Versar analyses are presented in Table 2 with an identifying footnote.

3.3 BARIUM

Table 3 presents the results of barium analyses for the samples taken at the Kummer site. The target detection limit of 10 μg/L specified in the sampling plan was achieved. Only one ground-water sample, 11B was reported below the target detection limit and was assigned the "U" qualifier indicating that barium was not detected in the sample.

3.4 QUALITY CONTROL

Several parameters require review to assess data quality for this sampling effort. In general, all data generated during this sampling effort fell within the acceptable ranges of the quality control parameters specified in the sampling plan. Analytical results for the field equipment blanks, trip blanks, and field duplicate samples are presented for VOC and barium data in Tables 2 and 3, respectively. Specific parameters and deviations from quality control ranges are discussed in detail below.

TABLE 2

VOLATILE ORGANIC COMPOUND ANALYSES[1]
APRIL 27 AND 28, 1992

Sample No.[2]	Vinyl Chloride (µg/L)	Trans-1,2-dichloroethene (DCE) (µg/L)	Trichloroethene (TCE) (µg/L)	Tetrachloroethene (PCE) (µg/L)	Benzene (µg/L)
3C	<10 UC	<5.0 U	<0.5 U	<0.5 U	<5.0 U
2B	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
2B-Duplicate	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
3B	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
11B-Blank	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
11B	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
1C	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
1B	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
Trip Blank (4/27/92)	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U
1A	<10 UC	<5.0 U	<0.5 U	0.31 J	<5.0 U
3A	12 C	<5.0 U	<0.5 U	<0.5 U	<5.0 U
7A-Blank	<50 U	13.4	<0.5 U	<0.5 U	<5.0 U
7A	8 JC	<5.0 U	0.13 J	0.18 J	<5.0 U
2A	<10 UC	<5.0 U	0.44 J	<0.5 U	<5.0 U
12B-45	25 C	8.6	0.15 J	<0.5 U	<5.0 U
12B-38	33 C	<5.0	<0.5 U	<0.5 U	<5.0 U
12B-38 - Duplicate	<50 U	2.0 J	0.15 J	<0.5 U	<5.0 U
12B-31	35 C	7.1	0.16 J	<0.5 U	3 JC
Trip Blank (4/28/92)	<50 U	<5.0 U	<0.5 U	<0.5 U	<5.0 U

Notes:

1 Analyses performed by PRC's FAS laboratory and Versar; data quality objective: EPA Level 3
2 Samples numbers are reported in the order that wells were sampled in the field
U Nondetect; numerical value reported is SQL.
J Analyte observed below the SQL; reported value estimated
C Confirmatory analysis by Versar; SQL for vinyl chloride = 10 µg/L

TABLE 3

BARIUM ANALYSES[1]
APRIL 27 AND 28, 1992

Sample No.[2]	Barium Concentration (µg/L)
3C	31
2B	4,200
2B-duplicate	4,440
3B	72
11B[3]	<10 U
1C	77
1B	360
1B-duplicate	480
1A	82
3A	1,700
7A-Blank	<10 U
7A	500
2A	2,100
12B-45	180
12B-38	250
12B-31	27

Notes:

1 Analyses performed by PRC's field analytical support (FAS) laboratory; EPA data quality objective: Level 3

2 Samples numbers are reported in the order that wells were sampled in the field.

3 The 11B field equipment blank was not analyzed for barium.

U Nondetect; numerical value reported is SQL

Sample holding times: All samples were analyzed within the holding times specified in the sampling plan for VOCs and barium. Also, the additional VOC analysis discussed in Section 3.2 was completed by Versar within the holding time of 10 days.

Calibration: All calibrations met the quality control specifications in the sampling plan, except for the initial calibration of the graphite furnace atomic absorption spectrophotometer (AA). The correlation coefficient of 0.98963 is less than the coefficient of 0.995 specified in the sampling plan.

Trip blanks: Trip blanks for VOC analysis were collected at the beginning of each day. Results from each trip blank show that no VOC cross-contamination occurred during sample shipment and storage.

Field equipment blanks: Field equipment blanks were collected before sampling at wells 7A and 11B. The 7A field equipment blank showed no cross-contamination of barium from the equipment; however, the 11B field equipment blank was not analyzed. The nondetect results of the actual 11B sample support the conclusion that no barium cross-contamination resulted from the equipment.

Both equipment blanks (7A and 11B) were analyzed for VOCs. The 11B blank showed no cross-contamination. The 7A equipment blank contained 13.4 µg/L of trans-1,2-dichloroethene (DCE). The sample collected prior to the equipment blank, 3A, and the sample collected subsequent to the equipment blank, 7A, were both nondetects, which indicates the contamination did not come from ground water or sampling equipment. This result may indicate contamination within the laboratory. Two bladder pumps were used for this sampling effort. Because of the complexity involved in sampling well 12B with the pump and packer assembly, the bladder pump used at 12B was dedicated to that well for the entire day, and was not used on any other wells that were expected to be contaminated. It is important to note that the only DCE measurements in excess of the 5 µg/L SQL were measured at well 12B.

Accuracy and Precision: All accuracy and precision quality control specifications for both the VOC and barium analyses in the sampling plan were met. Acceptable ranges for precision, expressed as relative percent difference (RPD), for barium and VOCs were ± 25 % and ±75 %, respectively. The specified accuracy ranges, expressed as percent recovery (R), for barium and VOCs are 75 % to 125 % and 30 % to 150 %, respectively.

4.0 DATA EVALUATION

One objective of this sampling effort was to define current ground-water contaminant concentrations at the site. Except for vinyl chloride, all of the VOC contaminants of concern were measured in all sampled wells in concentrations below the target detection limits of 10 μg/L. Vinyl chloride was measured in all wells at below 50 μg/L. Confirmatory sampling by Versar showed that vinyl chloride was present in excess of 10 μg/L in well 3A and all three intervals of well 12B. Samples from wells 1A, 2A, and 7A showed vinyl chloride present at or below the target detection limit of 10 μg/L. Barium was measured in all wells but one (well 11B) in excess of the target detection limit of 10 μg/L.

The results from this sampling effort did not exceed any of the maximum contaminant levels (MCL) for DCE, TCE, PCE, and benzene. The MCL for vinyl chloride is 2 μg/L, which is lower than the SQLs achieved by PRC and Versar. Therefore, it is impossible to determine that any of the samples were below the vinyl chloride MCL. The confirmatory samples analyzed by Versar show vinyl chloride concentrations that follow a pattern established in previous sampling efforts. The shallowest wells (1A, 2A, 3A, and 7A) and well 12B showed concentrations of vinyl chloride and other VOCs which may indicate contaminant migration from the landfill.

Analysis of barium in the ground water revealed concentrations of barium in excess of the MCL of 1,000 μg/L in wells 2A, 2B, and 3A. These wells are shallow and near the eastern boundary of the site. In January 1993, the MCL for barium will rise to 2,000 μg/L.

5.0 SUMMARY

Concentrations of VOCs are generally comparable to concentrations measured in August 1991 and January 1992 by MPCA. Barium results are comparable, and at some wells, lower than the concentrations reported by MPCA in August 1991. Both the MPCA results and the results of this effort show lower concentrations of barium and VOCs at the sampled wells than the concentrations reported in the RI.

Because the landfill cap was completed (although not vegetated) in late 1991, it is premature to conclude that the cap has effectively reduced contaminant migration to the ground water. Ongoing monitoring will be necessary to support such a conclusion. However, the results

of this sampling effort indicate lower concentrations of barium and VOCs at wells downgradient of the site than observed in the past.